1853MNRAS..14...62L

completely altered in consequence of the introduction of the new terms.

The numerical effect of this alteration is to diminish by 1″·66 the coefficient of the square of the time in the expression for the secular acceleration; the time being, as usual, expressed in centuries.

It will, of course, be necessary to carry the approximation much further, in order to obtain such a value of this coefficient as may be employed with confidence in the calculation of ancient eclipses.

Considerations of a General Nature relative to the small Planets situate between Mars and Jupiter. By M. Le Verrier.*

M. Le Verrier commences this brief communication by remarking that the hypothesis of Olbers respecting the origin of the small planets, which the great inclination of the orbit of *Pallas* did not serve to confirm, has been completely negatived by the numerous discoveries of recent years. It is to be hoped, he adds, that, since the hypothesis of Olbers must be renounced, the knowledge of a great number of such bodies may finally lead to the discovery of some law regulating their distribution in space. He then proceeds to some general considerations respecting the twenty-six planets already discovered, omitting all reference to the twenty-seventh planet which had been recently discovered by Mr. Hind.

The small planets revolve in a zone which commences at the mean distance of 2·20 from the sun, and extends to the distance 3·16. The mean value of their excentricities is 0·155. The magnitude of the excentricity in individual cases does not seem to have any relation either to the mean distance from the sun or to the position of the perihelion.

The inclinations of the orbits, whether with respect to each other or to the ecliptic, are in both cases considerable. The individual magnitude of the inclinations does not appear to depend either on the mean distance from the sun or on the direction of the ascending node.

The perihelia and the ascending nodes offer some peculiar features. *Twenty* of the perihelia have their longitudes included between 4° and 184°. *Twenty-two* of the ascending nodes have their longitudes between 36° and 216°. M. Le Verrier appears somewhat inclined to suspect the existence of a systematic difference between the mean direction of the ascending nodes of the planets nearer the sun and that of the ascending node of the planets that are more remote, indicating the existence of two distinct groups. He then proceeds to investigate the superior limit of the total quantity of matter which may be distributed in the zone of the heavens under consideration.

An inquiry of this nature can only be conducted by an exa-

---

* *Comptes Rendus*, Nov. 28, 1853.

1853MNRAS..14...62L

mination of the action of such a mass of matter on the neighbouring planets *Mars* and the Earth. It is manifest that the periodic inequalities resulting from the action of the small planets (whose aggregate mass it is proposed to determine) cannot fail mainly to destroy each other by their opposite effects at any assigned instant, and, therefore, must form an unsuitable groundwork for such an investigation.

The secular inequalities being independent of the relative positions of the planets, are not attended with the inconvenience to which reference has just been made, M. Le Verrier remarks that the secular variation of the perihelion of the Earth or *Mars* contains two terms depending on the action of the small planets, one of which is especially adapted for determining the aggregate of their mass. This term depends exclusively on the mean distance of the disturbing planet from the sun, and on the excentricity of the disturbed planet; further, it is essentially positive. It is manifest, therefore, that if the zone, which includes the small planets, contains an innumerable number of such bodies, their respective masses will act together upon the perihelion of the disturbed planet in the same manner as if they were concentrated into one single mass acting at a suitable distance.

With respect to the second term, which is of the same order of magnitude with the first, M. Le Verrier remarks that it depends on the excentricity and the longitude of the perihelion of the disturbing body. In the case of the Earth, since its perihelion is placed almost in the middle of the region of the heavens occupied by the perihelia of more than three-fourths of the small planets, this term might become sensible and contrary in sign to the first term, more especially as the mean excentricity of the small planets is nine times as great as the excentricity of the terrestrial orbit. M. Le Verrier, upon this ground, rejects the secular variation of the terrestrial perihelion as incapable of furnishing a definitive solution of the question under consideration, although its actual value has been ascertained with greater accuracy than that of *Mars*.

With respect to the perihelion of *Mars*, it is more favourably situated relatively to the perihelia of the small planets; moreover, the excentricity of this planet is considerable. By reason of both these circumstances, it happens in this case that the second term does not amount to more than one-fourth of the first term, and it may be expected that this superiority of the first term will continue to subsist after numerous future discoveries of small planets.

Agreeably to these remarks, M. Le Verrier finds that if the aggregate of the masses of the small planets equalled the Earth's mass, it would occasion a variation of the heliocentric longitude of the perihelion of *Mars* amounting to eleven seconds of space in a century. Now, if a variation amounting to even the fourth of this quantity affected the perihelion of the planet, it could not fail to be detected by astronomers, and as no evidence of such a variation exists, it follows as a necessary consequence, *that the total quantity of matter composing the small planets situate between the*

1853MNRAS..14...62L

mean distances 2·20 and 3·16 cannot amount to more than about a quarter of the Earth's mass.

M. Le Verrier remarks that a similar result might be obtained by a consideration of the secular variation of the plane of the ecliptic, but in this case the limit would not be so confined.

CONTENTS.

Page
Fellows elected 33
Discovery of a new Comet by M. Klinkerfues 33
Elements of ditto 33
Observations of Comet III. 1853, by Commander Bradshaw 33
Second Elements of *Euterpe*, by Prof. Chevallier and M. G. Rümker ... 34
Observations of *Euterpe*, by Mr. Carrington 35
Remarks respecting a Phenomenon observed during the apparition of Comet III. 1853, by M. C. Rümker 35
Extracts of a Letter from Prof. C. Piazzi Smyth 38
Remarks by Mr. Carrington on presenting to the Society nine Circumpolar Charts 40
On a new Mode of Mounting a Telescope equatoreally, by Mr. Joseph Hopkins 41
Description of a Miniature Observatory, by Messrs. Ellis and Son, (communicated by Dr. Lee) 44
Remarks on the Zodiacal Light, by Mr. Burr 45
Statement made by the President respecting the Operations for Determining the Difference of Longitude of Greenwich and Brussels by Galvanic Signals 46
Note on the Rating of Chronometers by Lunars 46
Nautical Almanac for 1857 47
On the Determination of the Longitude of Papeété by means of an Eclipse of the Sun 48
On the Parallax of Argelander's Star, by M. Peters 49
Observations made at the Observatory of the Collegio Romano in the year 1851, by Prof. Secchi 52
On the Theory of the Motion of the Pendulum, taking into account the Rotation of the Earth, by M Hansen 53
On the Secular Variation of tl Moon's Mean Motion, by Mr. Adams ... 59
Considerations of a General ıture relative to the small Planets situate between *Mars* and *Jupite* by M. Le Verrier 62

London:—Printed by G. Barclay, Castle St. Leicester Sq.